PATENT SPECIFICATION

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PROVISIONAL SPECIFICATION

Improvements in Portable Power Driven Screw Drivers or other Means for Effecting a Turning Effort

We, Sir W. G. ARMSTRONG WHITWORTH AND COMPANY (ENGINEERS) LIMITED, a British Company, and THOMAS CLARK REAVELY, a British Subject, both of Scotswood Works, in the City and County of Newcastle-on-Tyne, England, do hereby declare the nature of this invention to be as follows:—

This invention relates to portable power driven screw drivers or other means for effecting a turning effort of the kind in which the drive is transmitted to the screw driver or other tool through a slipping clutch.

Hitherto when an extra effort has been required either for initial slackening or final tightening of a screw, this has been effected by providing a dog clutch between the screw driver and the driving mechanism which normally was disengaged, and engaged by the action of pressing the tool against the work, so that by temporarily relieving pressure on the tool the clutch disengaged and allowed the motor to speed up, when pressure was again exerted on the tool to cause the sudden engagement of the clutch and so subject the screw driver to a relatively heavy impact. This arrangement had the disadvantage that fracture of the dog teeth frequently resulted. In another arrangement means were provided whereby the tension of a spring which kept the clutch members normally engaged was temporarily increased by manually moving one of the abutments of the spring to compress the latter. This arrangement obviated fractures but required a separate operation to effect the temporary increase of pressure between the clutch faces.

The object of the present invention is to provide means whereby when a final or initial effort is required the instinctive action of the operator in pressing the tool harder against the work automatically produces such further effort.

Another object of the invention is to provide means for cooling the clutch.

According to the invention the clutch is arranged in axial alignment with the screw driver or other tool (hereinafter referred to as the screw driver) and has one of its members abutting against the said screw driver either directly or indirectly for example through a ball race, so that according to the amount of pressure exerted by the operator so the amount of torque transmitted from he motor will be varied.

According to one form of construction the one clutch member is driven direct from the motor and its driven member is rigid with a shaft mounted at one end in a bearing in the driving clutch member, and at the other end in a bearing in the tool casing, the outer end of the said shaft being adapted to receive one half of a thrust bearing the other half of which is mounted on the end of an axially slidable rod which will be more fully referred to hereafter.

On the clutch shaft there is mounted a pinion which engages with a gear wheel on one end of a lay shaft mounted in bearings in the tool casing, the said lay shaft having at its other end a pinion which in its turn engages a gear wheel mounted on a tool spindle in axial alignment with the clutch. The said tool spindle is bored to receive the slidable rod above referred to and is also recessed to receive a light helical spring arranged around the said rod and adapted to press it against the clutch shaft through the said thrust bearing.

The outer end of the said tool spindle has a socket formed thereon to receive the squared or other suitably shaped shank of the screw driver which is a sliding fit in the said socket.

As will be seen the drive is through the clutch and the train of gearing, but owing to the slidable mounting of the screw driver in its socket, pressure may be exerted on the clutch by pressing inwardly on the screw driver. In use, the operator will normally exert a relatively light pressure just sufficient to transmit a drive through the clutch to the screw driver. When it is desired to get a momentary extra effort, the operator relieves the pressure so as to allow the motor to speed up, and then when the motor is revolving at its maximum speed he exerts a sudden greater forward pressure and so exerts a powerful turning effort upon the screw

[*Price* 1/-]

Price 4s 6d

being driven. This procedure very closely approximates to the usual sequence of actions in driving in screws by hand, so that it has the advantage that the operator does not require to learn any new technique in connection with the handling of the tool.

For cooling the clutch, in the case of a pneumatic tool the exhaust air may be led to a point adjacent the clutch so that it always plays upon it. For an electric tool a small fan may be included in the tool to induce a current of air which is directed on the clutch.

Dated this 23rd day of September, 1933.

For the Applicants,
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Chartered Patent Agents,
31 and 32, Bedford Street, Strand, W.C.2, London, and
32, Grainger Street, West Newcastle-on-Tyne 1.

COMPLETE SPECIFICATION

Improvements in Power Driven Screw Drivers or other Means for Effecting a Turning Effort

We, Sir W. G. ARMSTRONG WHITWORTH AND COMPANY (ENGINEERS) LIMITED, a British Company, and THOMAS CLARK REAVELY, a British Subject, both of Scotswood Works, in the City and County of Newcastle-on-Tyne, England, do hereby declare the nature of this invention and in what manner the same is to be performed to be particularly described and ascertained in and by the following statement:—

This invention relates to power driven screw drivers, spanners and the like of the kind in which the drive is transmitted to the screw driver or other tool through a frictional slipping clutch arranged so that the torque transmitted from the motor to the tool bit varies according to the pressure exerted on the tool, the clutch being either normally in engagement or normally out of engagement.

The object of the invention is to provide a tool of the kind above described which will be light and compact but at the same time capable of exerting considerable turning effort, such a tool being particularly adapted for use in connection with portable tools, although the invention may be equally applicable to non-portable tools.

It has been proposed to transmit the drive in a portable power driven rotary tool of the kind referred to through a reduction gearing, a toothed clutch transmitting the final reduced drive, and in some of such arrangements the drive was transmitted from the motor to the reduction gear through a slipping clutch. However, the slipping clutch was unaffected by the pressure exerted on the tool, while although it was pressure on the tool which effected engagement of the clutch, yet owing to the engagement being by means of teeth, once engagement was effected further pressure on the tool had no effect on the clutch. In one such toothed clutch proposal the teeth were bevelled to allow slip with a view to imparting a series of axial and tangential impulses to the bit, the force of the said impulses therefore depending on the degree of pressure exerted by the operator. Further, as the highest torque in the drive has to be transmitted by the clutch, this latter necessarily has to be of relatively heavy construction in order to be able to cope with the heavy torques necessary. In another proposal the reduction gearing and clutch were formed by the same members and comprised a conical friction epicyclic gear so arranged that axial pressure on the handle caused the sun-wheel or cone to press against the planet-wheels and so effect engagement in accordance with the pressure exerted on the tool.

According to the present invention, the drive is transmitted from the motor to the tool bit through a reduction gear the function of which is separate from that of the slipping clutch. Preferably the said clutch is interposed between the motor and the reduction gear, so that as the torque is lowest in such a position of the clutch, the latter may be made relatively light.

Owing to the high speed at which the clutch runs, another object of the invention is to provide means for cooling the said clutch.

The invention will now be described by way of example with reference to the accompanying drawings:

In the said drawings:

Fig. 1 is a partial sectional elevation of a power driven screw driver in which the clutch members are normally held in contact by a spring.

Fig. 2 is a partial sectional elevation of a similar tool to Fig. 1 but with the clutch members normally held apart by a spring.

Referring more particularly to Fig. 1 of the drawings, 1 is the motor casing, 2 the gear casing and 3 the motor shaft. 4 is the driving clutch member mounted on

the shaft 3 and 5 is the driven clutch member which is rigid with a shaft 6 mounted at one end in a bearing 7 in the driving clutch member 4, and at the other end in a bearing 8 in a housing 9, the outer end of the said shaft 6 being adapted to receive one half of a thrust bearing 10 the other half of which is mounted on the end of an axially slidable rod 11 which will be more fully referred to hereafter.

On the clutch shaft 6 there is mounted a sun pinion 12 which engages with a planet pinion 13 on one end of the housing 9 the outer end of which is mounted in a bearing 14 in an extension 15*a* of the tool spindle 15. The said housing 9 has at its outer end a sun pinion 16 which in its turn engages a planet pinion 17 mounted on the said tool spindle extension 15*a*, the tool spindle 15 being in axial alignment with the clutch 4, 5. The planet pinions 13 and 17 mesh respectively with the gear rings 2*a*, 2*b* integral with the gear casing 2. The said tool spindle 15 is bored to receive the slidable rod 11 above referred to and is also recessed to receive a light helical spring 18 arranged around the said rod and adapted to press against a shoulder 11*a* thereon so as to press the rod against the clutch shaft 6 through the thrust bearing 10 and so maintain the clutch members 4, 5 in engagement.

The outer end of the tool spindle 15 has a socket 15*b* formed thereon to receive the squared or other suitably shaped shank of the screw driver bit 19 which is a sliding fit in the said socket. A flared sleeve 20 is loosely mounted about the bit 19 to embrace the end of the screw head to be driven, and serves to maintain the bit 19 in engagement with the screw head.

As will be seen the drive is through the clutch 4, 5 and the train of gearing 12, 13, 2*a*, 16, 17, 2*b*, but owing to the slidable mounting of the screw driver 19 in its socket 15*b*, pressure may be exerted on the clutch by pressing inwardly on the screw driver.

In use, the operator will normally exert a relatively light pressure just sufficient to transmit a drive through the clutch to the screw driver. When it is desired to get a momentary extra effort, the operator relieves the pressure so as to allow the motor to speed up, and then when the motor is revolving at its maximum speed he exerts a sudden greater forward pressure and so exerts a powerful turning effort upon the screw being driven. This procedure very closely approximates to the usual sequence of actions in driving in screws by hand, so that it has the advantage that the operator does not require to learn any new technique in connection with the handling of the tool.

In the tool shown in Fig. 2, the construction is similar to that of the tool shown in Fig. 1, but instead of the spring 18 being arranged about the rod 11, a spring 21 is arranged in a recess 5*a* in the driven clutch member 5, its ends abutting against the end of the recess 5*a* and the end of the shaft 3, so that the clutch members 4, 5 are maintained out of engagement when there is no pressure exerted on the tool.

In the tool shown in Fig. 1 the tool bit will always rotate owing to the clutch members 4, 5 being constantly engaged. In the tool shown in Fig. 2 owing to the clutch members 4, 5 being normally out of engagement, the operator is able to keep the motor running while the screw-driving bit is stationary. He is thus able to insert the bit into the head of the screw before applying the power, which he does by merely pushing the whole tool hard up against the screw thereby bringing the two clutch members 4, 5 into engagement.

For cooling the clutch, in the case of a pneumatic tool air, for example the exhaust air, may be led to a point adjacent the clutch so that it always plays upon it. For example in Fig. 1 holes at 22*a* may be formed in the stator liner 22, and adapted to register with corresponding holes 23*a* in the stator casing 23, the said holes 23*a* opening into a passage 1*a* in the casing 1 terminating adjacent the clutch, so that instead of exhausting the air direct to the atmosphere it may be directed on to the clutch and subsequently exhausted to the atmosphere through an exhaust orifice 1*b* diametrically opposite the end of the passage 1*a*.

For a tool driven by an electric motor a small fan may be included in the tool to induce a current of air which is directed on the clutch. For example in Fig. 2 a fan 24 may be mounted on the motor shaft 3 inside a casing 25 which on the one hand is open to the atmosphere by means of an inlet orifice 25*a* and on the other hand has one or more outlet orifices 25*b* adjacent the clutch, so that air is blown on to the clutch and subsequently passes to the atmosphere through the exhaust orifice 1*b*.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A power driven screw driver or the like, of the kind described, in which the drive is transmitted from the motor to the tool bit through a reduction gear the function of which is separate from that of the slipping clutch.

2. Means according to claim 1 characterized in that the clutch is interposed between the motor and the reduction gearing for the purpose set forth.

3. Means according to either of claims 1 and 2, wherein the tool bit is slidably mounted in the tool spindle driven from the driven clutch member, while an axially slidable rod is inserted between the said tool bit and the driven clutch member so as to transmit a thrust between the bit and the said clutch member with a view to effecting engagement of the clutch.

4. Means according to any of the preceding claims and comprising a pneumatic motor wherein air, for example the exhaust air from the motor, is led to a point adjacent the clutch so that it is cooled.

5. Means according to claim 4 comprising the exhaust air cooling means substantially as described with reference to and as illustrated in Fig. 1 of the accompanying drawings.

6. Power-driven screw drivers or the like having their parts arranged, combined and adapted to operate substantially as described with reference to and as illustrated in the accompanying drawings.

Dated this 24th day of September, 1934.

For the Applicants,
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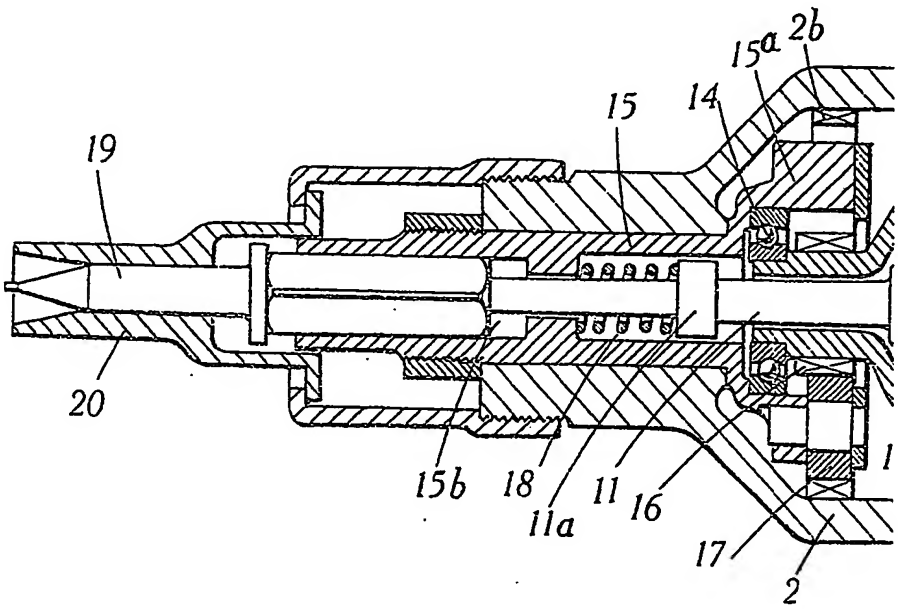
Fig. 1



Fig

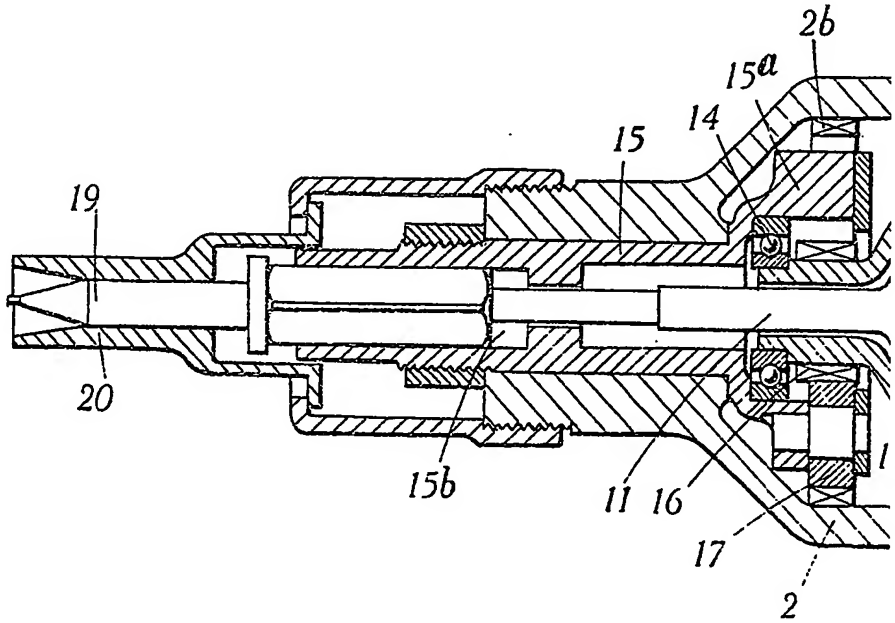


Fig. 1.

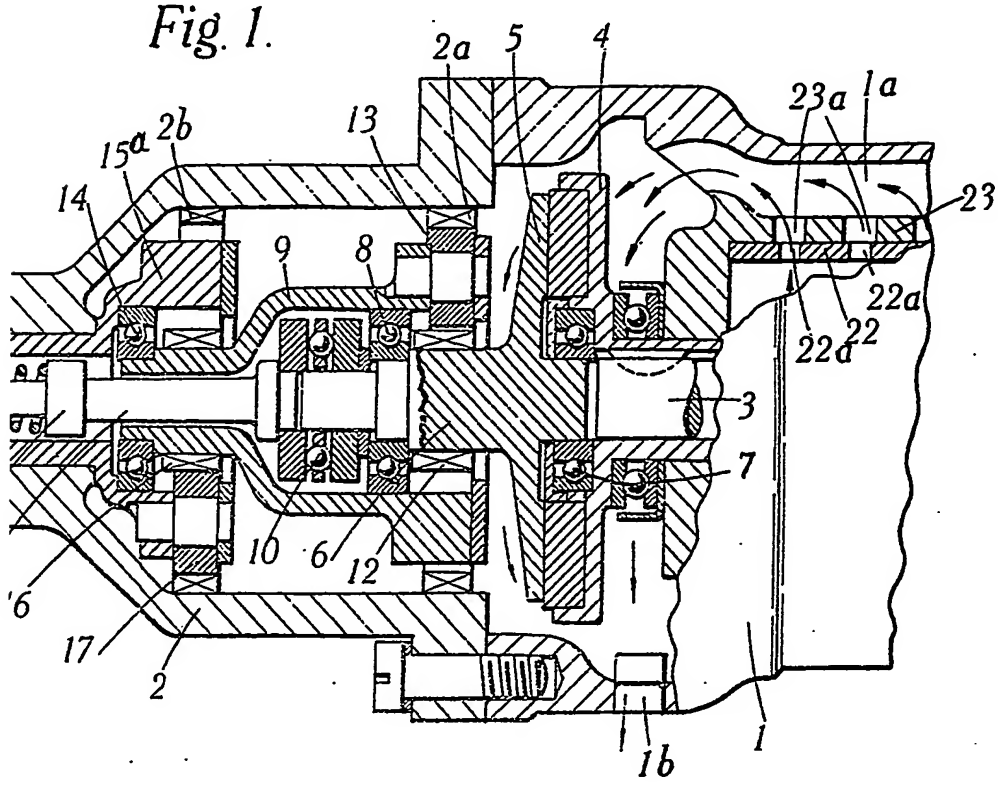


Fig. 2.

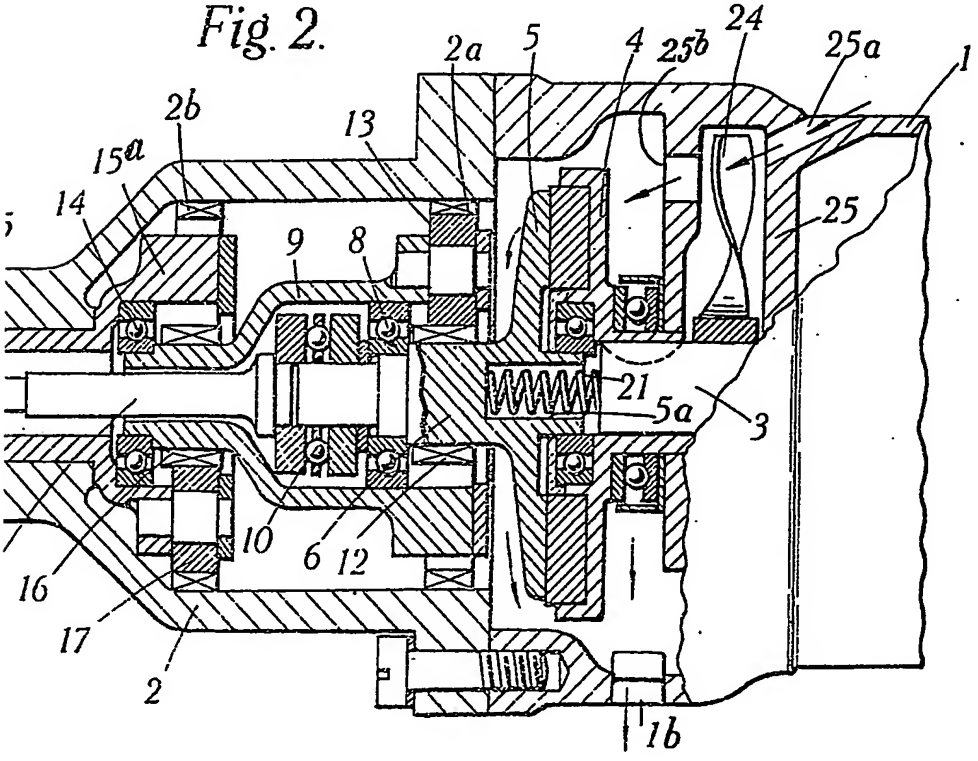


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Fig. 1.

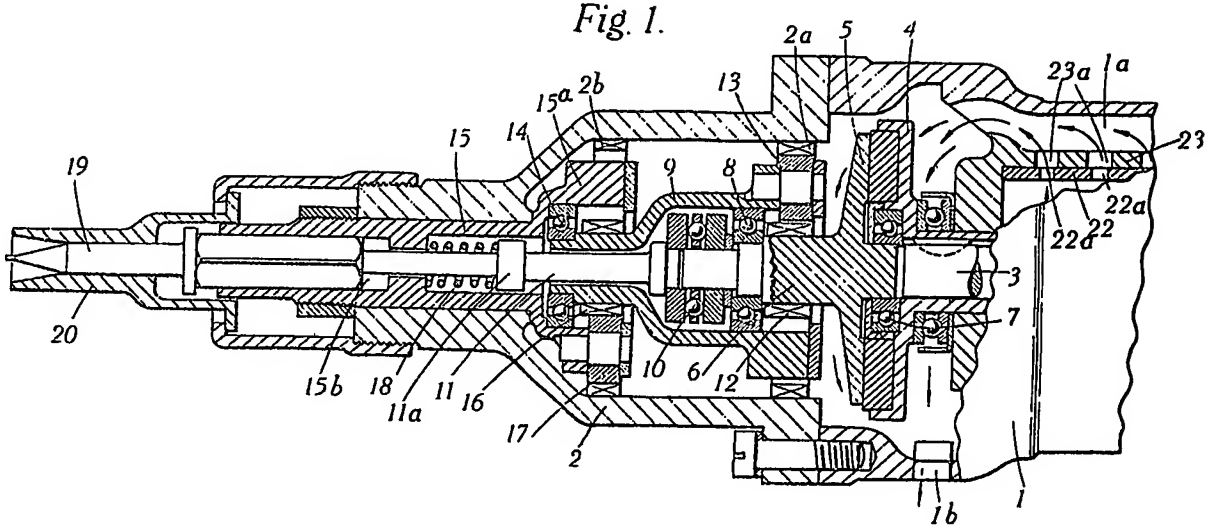

Fig. 2.